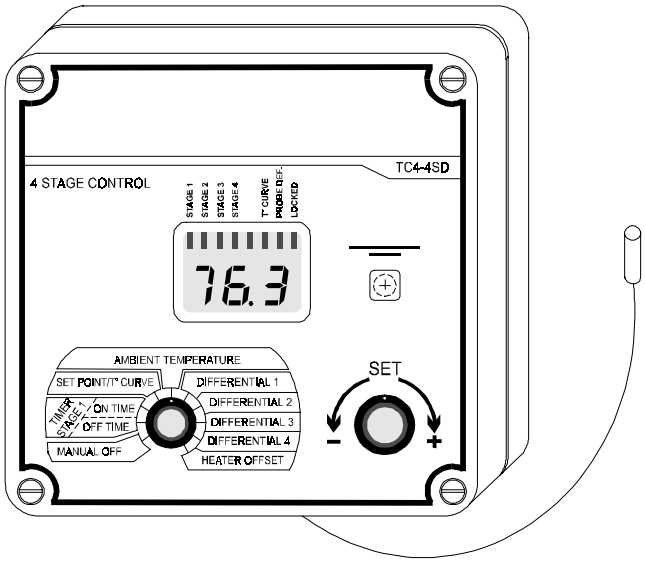
Environment Control

TC4-4SD

USER'S MANUAL



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PRECAUTIONS

We strongly recommend installing supplementary natural ventilation as well as a back-up thermostat on at least one cooling stage (refer to the wiring diagram enclosed with this user's manual to connect the thermostat).

Although fuses at the input and outputs of the controller protect its circuits in case of an overload or overvoltage, we recommend installing an additional protection device on the controller's supply circuit.

The room temperature where the controller is located MUST ALWAYS REMAIN BETWEEN 32°F AND 104°F (0°C TO 40°C).

To avoid exposing the controller to harmful gases or excessive humidity, it is preferable to install it in a corridor.

DO NOT SPRAY WATER ON THE CONTROLLER

FOR CUSTOMER USE
Enter the serial number located on the side of the controller below for future reference.

Model number: **TC4-4SD**
Serial number: _____

FEATURES

The TC4-4SD is an electronic device used for environmental control in livestock buildings. It allows the user to maintain a specified target temperature by controlling the operation of ventilation and heating equipment. Two stages of constant-speed fans can be connected to the controller, as well as two stages of either constant speed fans or heating units.

The main features of the TC4-4SD are as follows:

THREE-DIGIT DISPLAY

A three-digit display provides a high level of accuracy, allowing the user to specify a temperature to within one tenth of a degree (in Fahrenheit or Celsius units).

PILOT LIGHTS INDICATING STATE OF OUTPUTS

Pilot lights indicating the state of outputs allow the user to monitor the operation of the system without having to enter the building.

MINIMUM VENTILATION CYCLE

When ventilation is not required for cooling, the first stage fans can be operated either continously or intermittently to reduce the level of humidity and supply oxygen to the room.

MINIMUM VENTILATION COMPENSATION CURVE

An outside probe can be connected to the controller to adjust the minimum ventilation cycle as a function of outside temperature.

TEMPERATURE CURVE

The controller can be set to automatically change the temperature set point over a given period of time in accordance with the user's requirements by specifying a temperature curve with up to six different points.

FOUR INDEPENDENT TEMPERATURE PROBE INPUTS

Up to four temperature probes can be connected to the controller in order to obtain a more accurate reading of the average ambient temperature and a faster reaction time.

OVERLOAD AND OVERVOLTAGE PROTECTION

Fuses are installed at the input and outputs of the controller to protect its circuitry in the case of an overload or overvoltage.

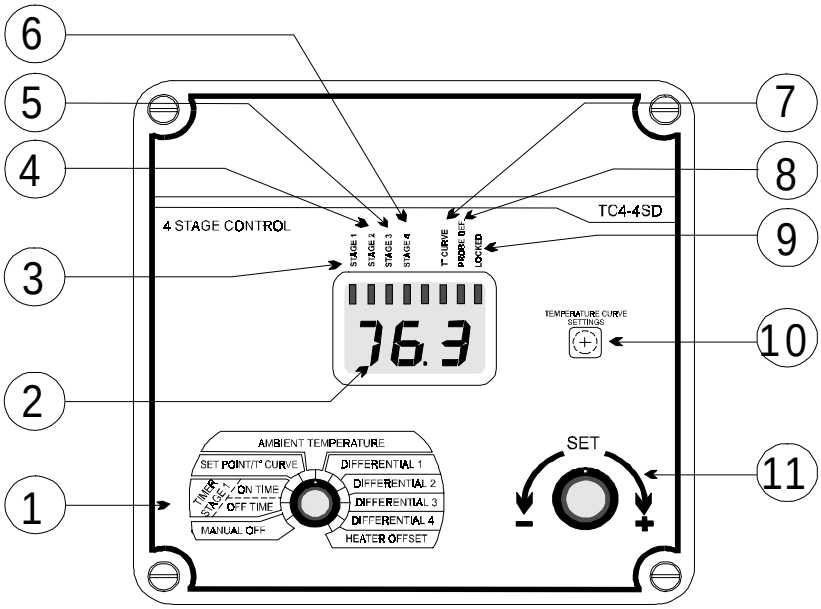
COMPUTER CONTROL

The controller can be connected to a computer, thus making it possible to centralize the management of information and diversify control strategies.

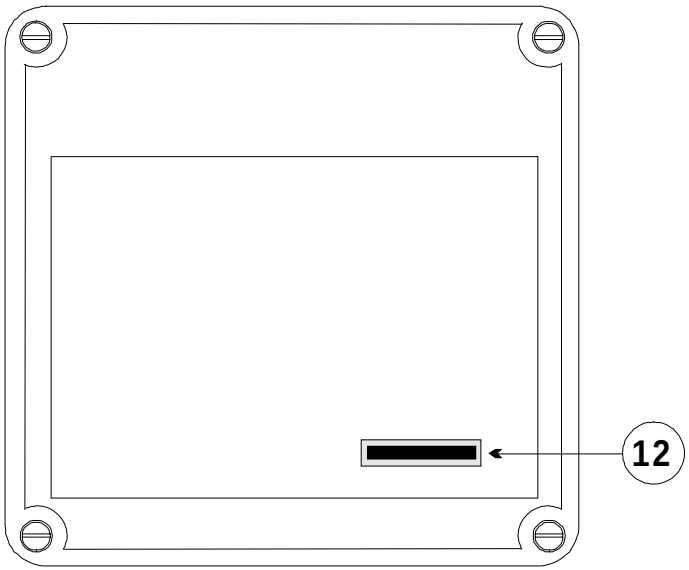
CONTROL OF AIR INLET MOVEMENT

If the TC4-4SD is used in combination with a PF-5 controller, the movement of the air inlets can be coordinated with the operation of the fans using a potentiometer located on the panel drive. This allows the air inlets to be adjusted correctly, without the influence of uncontrollable factors such as wind or air from adjoining rooms.

LOCATION OF THE CONTROLS



Front Cover



Internal Circuit

1 **Parameter selection Knob**
Used to select a parameter.

2 **Three-Digit Display**
Displays temperatures and other parameters shown on the Adjustment Knob.

3 **Stage 1 Pilot Light**
Turns on when Stage 1 fans are on.

4 **Stage 2 Pilot Light**
Turns on when Stage 2 fans are on.

5 **Stage 3 Pilot Light**
Turns on when Stage 3 fans or heating units are on.

6 **Stage 4 Pilot Light**
Turns on when Stage 4 fans or heating units are on.

7 **Temperature Curve Pilot Light**
Turns on when the temperature curve is activated.

8 **Defective Probe Pilot Light**
Turns on when a defective probe is detected.

9 **Locked Parameter Pilot Light**
Turns on when the parameters are locked.

10 **Push-Button for Other Functions**
Used to access other functions such as specifying the points of a temperature curve.

11 **Adjustment Knob**
Used to adjust the value of a selected parameter.

12 Internal Switches

The internal switches are located on the inside of the front cover and are defined in the following diagram:

#	OFF	ON
1	UNLOCKED PARAMETERS	LOCKED PARAMETERS
2	FAHRENHEIT DEGREES	CELSIUS DEGREES
3	PROBE 2 DISABLED	PROBE 2 ENABLED
4	PROBE 3 DISABLED	PROBE 3 ENABLED
5	PROBE 4 DISABLED	PROBE 4 ENABLED
6/7	6: OFF; 7: ON / OFF; STAGE 3 & 4 COOLING 6: ON; 7: ON; STAGE 3 & 4 HEATING 6: ON; 7: OFF; STAGE 3 COOLING, STAGE 4 HEATING	

NOTE : When the controller is shipped from the factory, all the switches are set to OFF.

FACTORY SETTINGS

PARAMETER		FACTORY SETTINGS	RANGE OF VALUES
Temperature Set Point		75 °F (23.9 °C)	-40 to 99.9 °F (-40 to 37.7 °C)
Temperature Curve[a]		OFF	days < 100
Stage 1	On Time	15 seconds	0 to 900 seconds
	Off Time	0 seconds	
	Differential 1	3 °F (1.7 °C)	0.5 to 20 °F (0.3 to 11.1 °C)
Differentials 2 to 4		2 °F (1.1 °C)	0.5 to 20 °F (0.3 to 11.1 °C)
Heater Offset[b]		0.5 °F (0.3 °C)	0 to 20 °F (0 to 11.1 °C)

NOTES :

i) These initial parameter settings will not be retained in the controller's memory. Each new setting will replace the preceding one.

ii) If the power supply is cut off, the last parameter settings will be retained in memory until the power is restored.

(a) The range of values for curve temperatures is 35°F to 99.9°F (1.7°C to 37.7°C).
(b) If the negative values option is activated, the range of values for the heater offset is -9.9°F to 20.0°F (-5.5°C to 11.1°C).

INSTALLATION

MOUNTING INSTRUCTIONS

Remove the four screws on the front cover and lift the cover. Mount the enclosure on the wall using three screws. Be sure the electrical knockouts are at the bottom of the enclosure in order to prevent water from entering the controller. Insert the screws in the mounting holes provided in three corners of the enclosure and tighten. Fasten the three black caps provided with the controller onto the three mounting holes.

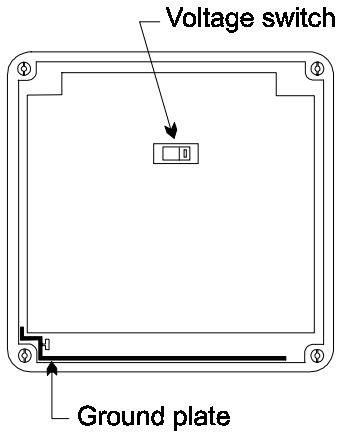
CONNECTIONS

To connect the controller, refer to the wiring diagram enclosed with this user's manual.

⇨ Set the voltage switch to the appropriate voltage.

⇨ Use the electrical knockouts provided at the bottom of the enclosure. Do not make additional holes in the enclosure, particularly on the side of the enclosure when using a computer communications module.

⇨ If metallic cable holders are used to secure cables entering the enclosure, use the ground plate provided with the controller. Connect the ground wire to the ground stud on the plate.



Inside of the enclosure

⇨ If Stages 3 & 4 are used for heating, it may be necessary to install a transformer in order to supply the appropriate voltage to the heating unit.

ALL WIRING MUST BE DONE BY AN AUTHORIZED ELECTRICIAN AND MUST COMPLY WITH APPLICABLE CODES, LAWS AND REGULATIONS. BE SURE POWER IS OFF BEFORE DOING ANY WIRING TO AVOID ELECTRICAL SHOCKS AND EQUIPMENT DAMAGE.

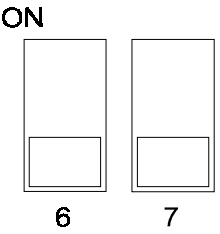
HEATING / COOLING OPTION

Stages 3 and 4 can operate as heating or cooling stages.

⇨ Set switches # 6 and # 7 to **OFF** to use both stages for cooling.

⇨ Set switch # 6 to **ON** and switch # 7 to **OFF** to use Stage 4 for heating and Stage 3 for cooling.

⇨ Set switches # 6 and # 7 to **ON** to use both stages for heating.



Note that if only one stage is used for heating, it must be Stage 4.

TEMPERATURE PROBES

1 Connecting the Probes

The controller is supplied with one temperature probe connected to terminal #1. Up to three additional probes can be connected to obtain more accurate readings and a faster reaction time.

⇨ Use terminals # 2, 3 and 4 to connect additional probes, as shown on the wiring diagram enclosed.

CAUTION: Probes operate at low voltage and are insulated from the supply. Be sure that probe cables remain insulated from all high voltage sources. In particular, do not route the probe cables through the same electrical knockout as other cables. Do not connect the shield from the probe cable to a terminal or a ground.

2 Extending the Probes

Each probe can be extended up to 500 feet (150 m):

⇨ Use a shielded cable of outside diameter between 0.245 and 0.260 in (6.22 and 6.60 mm) to ensure the cable entry is liquid tight (cable dimensions should not be under 18 AWG). Do not ground the shielding.

⇨ It is preferable to weld the cable joint to ensure a proper contact between the two cables.

CAUTION: Do not run probe cables next to other power cables. When crossing over other cables, cross at 90°.

3 Detecting Faulty Probes

If a faulty probe is detected, the Defective Probe pilot light turns on. The ambient temperature shown on the display is then the average temperature measured by the probes in working condition. The controller will operate according to this temperature. If all the probes are defective, the display shows "P".

To identify the faulty probe:

⇨Set the selection knob to **AMBIENT TEMPERATURE**. The ambient temperature is displayed.

⇨Press the push-button. If the probe connected to terminal # 1 is not faulty, "**Pr 1**" is displayed, alternating with the temperature measured by the probe. Otherwise, "**Pr 1**" alternates with "**P**".

⇨Keep pressing the push-button to view the status of the other probes.

CHANGING THE PARAMETER SETTINGS

THE MEANING OF A FLASHING DISPLAY

The display will flash in certain cases and not in others. The flashing indicates that the value shown can be adjusted. A value that is not flashing cannot be adjusted.

LOCKING THE PARAMETER SETTINGS

The parameter settings can be locked to prevent accidentally modifying them. When the settings are locked, only the temperature set point and the On/Off switch for the temperature curve can be modified.

To lock the parameter settings:

⇨ Set internal switch # 1 to **ON**. The Locked Parameter Pilot Light turns on.

To unlock the parameter settings:

⇨ Set internal switch # 1 to **OFF**. The Locked Parameter Pilot Light turns off.

MANUAL OFF

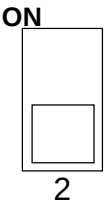
You can override the parameter settings at any time and turn off the four stages by turning the selection knob to **MANUAL OFF**. Turning the selection knob to any position other than **MANUAL OFF** will resume normal operation of the stages.

ADJUSTING THE TEMPERATURE

TEMPERATURE UNITS

Temperatures can be displayed in either Celsius or Fahrenheit units

⇨ Set internal switch # 2 to the desired position:



- **ON** to display temperatures in Celsius units.
- **OFF** to display temperatures in Fahrenheit units.

VIEWING TEMPERATURES

The readout can display values from -40.0 °F to 120.0 °F (-40.0 °C to48.9°C). When the temperature drops below -9.9 degrees, the negative sign is displayed separately, alternating with the numerical value.

1 Viewing the Room Temperature

The ambient temperature is the average value of all temperatures measured by activated probes in proper operating condition.

⇨ Set the selection knob to **AMBIENT TEMPERATURE**. The ambient temperature is displayed.

2 Viewing Probe Temperatures

The controller can display probe temperatures individually. Probes can also be turned on or off to control the temperature in different parts of the building using the inernal switches.

⇨ Set the selection knob to **AMBIENT TEMPERATURE**. The ambient temperature is displayed.

⇨ Press the push-button. "**Pr 1**" is displayed, alternating with the temperature measured by the probe connected to terminal # 1 (supplied with the controller).

⇨ Press the push-button once again to display the state of the probe, i.e. ON / OFF.

⇨ Press the push-button once again to display the temperature and state of probe 2, etc.

3 Viewing Minimum / Maximum Temperatures

The minimum and maximum temperatures are the lowest and highest temperature values recorded since the last reset. Temperatures values are averaged over all active probes.

⇨ Set the selection knob to **AMBIENT TEMPERATURE**. The ambient temperature is displayed.

⇨ Turn the adjustment knob clockwise by one notch. The minimum temperature flashes on the display.

⇨ Turn the adjustment knob counterclockwise one notch. The maximum temperature flashes on the display.

NOTE: If you let the display flash for more than 10 seconds, the controller resets the minimum and maximum temperatures currently in memory (the display stops flashing to indicate that the reset has been done).

TEMPERATURE SET POINT

The temperature set point is the target room temperature. It can be adjusted between -40.0°F and 99.9°F (-40.0°C and 37.7°C).

Adjusting the Temperature Set Point

⇨ Set the selection knob to **SET POINT / T° CURVE**.The current set point flashes on the display.

⇨ Use the adjustment knob to adjust the set point to the desired value.

NOTE: The temperature set point can be adjusted only if the temperature curve is deactivated (see following section).

TEMPERATURE CURVE

The user can define a temperature curve to adjust the set point automatically over a given time period.

A curve is defined using six points. Each point specifies a day number and a set point for that day. Once the points of the curve are defined, the curve must be activated. The controller will change the temperature set point every hour in a linear fashion between consecutive points of the curve. When the last point of the curve is reached, the temperature set point for that day is maintained until the curve is reactivated.

NOTES :

i) All six points of the curve must be specified. If six points are not needed, repeat the last temperature value for each unnecessary point.

ii) Certain restrictions apply to reduce the risk of errors:

– The highest possible day number is 99.

– Decreasing day numbers are not allowed.

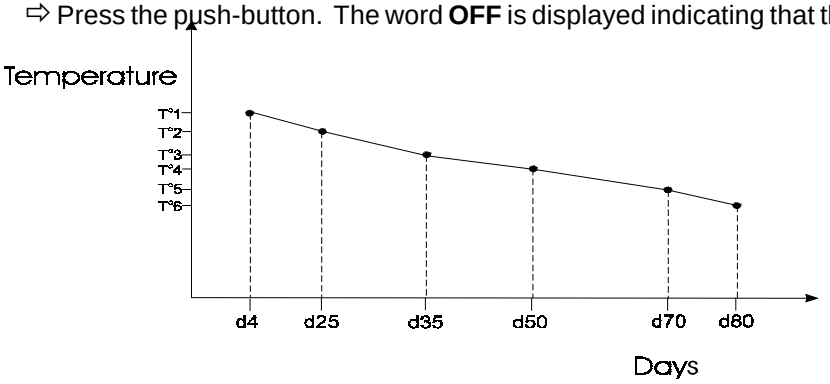
– Increasing temperatures are not allowed.

– The temperature variation cannot exceed 3°F (1.6°C) per day.

1 Specifying the Temperature Curve

⇨ Set the selection knob to **SET POINT / Tº CURVE**. The current temperature set point flashes on the display.

⇨ Press the push-button. The word **OFF** is displayed indicating that the



termperature curve is deactivated. If this is not the case, see below to deactivate the curve.

Repeat the following steps for each of the six points:

⇨ Press the push-button once again. The letter "**d**" followed by a day number flashes on the display.

⇨ Using the adjustment knob, set the day number to the desired value.

⇨ Press the push-button once again. The current temperature set point flashes on the display.

⇨ Using the adjustment knob, adjust the set point to the desired value.

Once the six points of the curve have been specified, activate the curve as explained below.

NOTE: Make sure the temperature curve is deactivated before specifying new points (see below).

2 Activating the Temperature Curve

If you have just finished specifying the points on the curve:

⇨ Press the push-button once again. The word **OFF** flashes on the display.

⇨ Turn the adjustment knob clockwise one notch and leave in this position for at least 10 seconds. The word **ON** flashes on the display and after 10 seconds, the Temperature Curve Pilot Light turns on indicating that the temperature curve is now activated.

⇨ Set the selection knob to **AMBIENT TEMPERATURE**.

If you have previously defined the points on the curve:

⇨ Set the selection knob to **SET POINT / T° CURVE**. The current value of the temperature set point flashes on the display.

⇨ Press the push-button. The word **OFF** flashes on the display.

⇨ Press the push-button to display the points of the curve currently defined until the word **OFF** appears (thirteen clicks).

⇨ Turn the adjustment knob clockwise one notch and leave in this position for at least 10 seconds. The word **ON** flashes on the display and after 10 seconds, the Temperature Curve Pilot Light turns on indicating that the temperature curve is now activated.

⇨ Set the selection knob to **AMBIENT TEMPERATURE**.

3 Viewing Current Set Point and Day Number

When the temperature curve is activated, the current temperature set point and day number can be viewed at any time. The current day number can also be adjusted in order to move forward or backward on the temperature curve.

⇨ Set the selection knob to **SET POINT / T° CURVE**. The current temperature set point flashes on the display.

⇨ Press the push-button. The current day number is displayed.

⇨ Use the adjustment knob to set the day number to the desired value.

4 Deactivating the Temperature Curve

⇨ Set the selection knob to **SET POINT / T° CURVE**. The current temperature set point flashes on the display.

⇨ Press the push-button to display the points of the curve actually defined until the word **ON** appears (fourteen clicks).

⇨ Turn the adjustment knob counterclockwise one notch and leave in this position for at least 10 seconds. The word **OFF** flashes on the display and after 10 seconds, the Temperature Curve Pilot Light turns off indicating that the temperature curve is now deactivated.

⇨ Set the selection knob to **AMBIENT TEMPERATURE**.

VENTILATION SETTINGS

COOLING OPERATION

The TC4-4SD controls two stages of constant-speed fans (Stages 1 and two) and two optional stages of constant-speed fans (Stages 3 and 4). For the description that follows, refer to the diagram on the following page.

If the room temperature rises:

When **Room T° < Set Point + Differential 1**, the Stage 1 fans run according to the minimum ventilation cycle.

When **Room T° = Set Point + Differential 1**, the Stage 1 fans run continuously.

When **Room T° = Set Point + Differential 1 + Differential 2**, the Stage 2 fans start to run.

When **Room T° = Set Point + Differential 1 + Differential 2 + Differential 3**, the Stage 3 fans start to run.

When **Room T° = Set Point + Differential 1 + Differential 2 + Differential 3 + Differential 4**, the Stage 4 fans start to run.

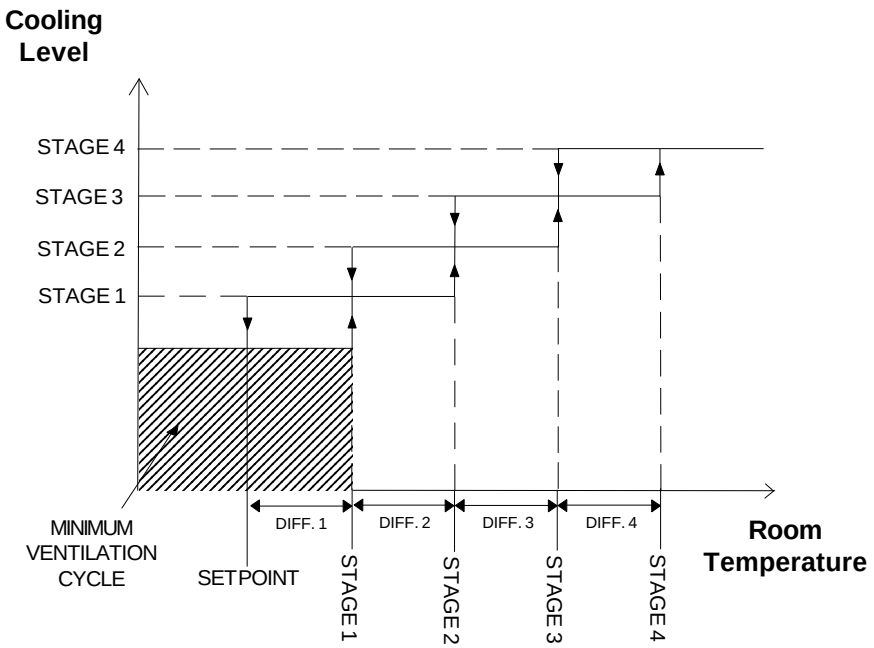
If the room temperature falls:

When **Room T° = Set Point + Differential 1 + Differential 2 + Differential 3**, the Stage 4 fans return to a stop.

When **Room T° = Set Point + Differential 1 + Differential 2**, the Stage 3 fans return to a stop.

When **Room T° = Set Point + Differential 1**, the Stage 2 fans return to a stop.

FIGURE 1: COOLING



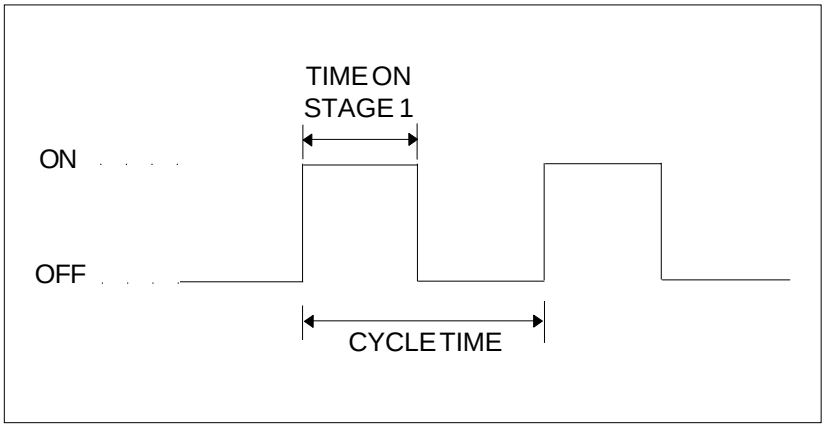
When **Room T° = Set Point**, the Stage 1 fans stop running continuously and start to run according to the minimum ventilation cycle.

When the room temperature drops below this point, the stage 1 fans operate according to the minimum ventilation cycle.

MINIMUM VENTILATION CYCLE

When the room temperature is below the set point, the Stage 1 fans operate according to the minimum ventilation cycle. Running the fans even though ventilation is not required for a cooling purpose is useful to reduce humidity levels and supply oxygen to the room. It also prevents the fans from freezing in winter.

Minimum Cycle



Minimum Ventilation Cycle Settings

1. To run the fans continously at minimum speed, set time on equal to cycle time.

2. To stop the fans, set time on to zero.

3. To run the fans intermittently, set time on to the desired running time and cycle time to on time plus off time.

1 Viewing and Adjusting On Time

⇨ Set the selection knob to **STAGE 1 TIMER - ON TIME**. The user-defined time on for the Stage 1 timer is displayed.

⇨ Use the adjustment knob to set the time on to the desired value.

Time on can be adjusted between 0 and 900 seconds, in increments of 15 seconds.

2 Viewing and Adjusting Off Time

⇨ Set the selection knob to **STAGE 1 TIMER - OFF TIME**. The current off time for the Stage 1 timer is displayed.

⇨ Use the adjustment knob to set the off time to the desired value.

The off time can be adjusted between 0 and 900 seconds, in increments of 15 seconds.

DIFFERENTIAL SETTINGS

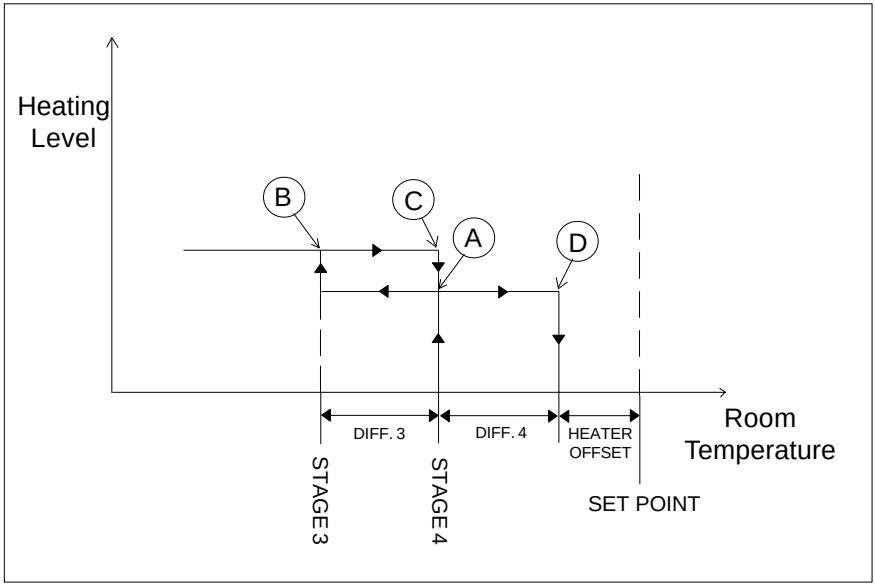
The differential for a given stage is the temperature difference between the moment the fans start to run for that stage and the moment they return to a stop (see the diagram at the beginning of this chapter). Differentials can be adjusted between 0.5°F and 20.0°F (0.3°C and 11.1°C).

⇨ Set the selection knob to the desired differential. The current differential flashes on the display.

⇨ Use the adjustment knob to adjust the differential to the desired value.

HEATER SETTINGS

If Stages 3 or 4 are not used for cooling, they can control heating units. Note that if only one stage is used for heating, it must be Stage 4.



If the room temperature falls:

When **room = set point - heater offset - differential 4**, the stage 4 heaters turn on (point A).

When **room = set point - heater offset - differential 4 - differential 3**, the stage 3 heaters turn on (point B).

If the room temperature rises:

When **room = set point - heater offset - differential 4**, the stage 3 heaters turn off (point C).

When **room = set point - heater offset**, the stage 4 heaters turn off (point D).

1 Adjusting the Heating Differentials

The heating differential is the temperature difference between the moment the heating units turn on and the moment they turn off (see the diagram above).

⇨ Set selection knob to **DIFFERENTIAL 4** or **DIFFERENTIAL 3**. The current differential for the selected stage flashes on the display.

⇨ Use the adjustment knob to adjust the differential to the desired value.

The differential can be adjusted between 0.5°F and 20.0°F (0.3°C and 11.1°C).

2 Adjusting the Heater Offset

The heater offset can provide substantial energy savings if correctly adjusted according to the outside temperature. It is the number of degrees below the set point at which the heaters turn off (see diagram above).

⇨ Set selection knob to **HEATER OFFSET**. The current heater offset flashes on the display.

⇨ Use the adjustment knob to adjust the heater offset to the desired value.

The heater offset can be adjusted between 0°F and 20.0°F (0°C and 11.1°C).

3 Enabling / Disabling Negative Heater Offset

Normally, the heater offset is set to a positive value. It may also be useful to set it to a negative value to allow the heating units to operate when the room temperature is above the set point. In that case, the negative heater offset must be activated.

⇨ Set the selection knob to **HEATER OFFSET**. The current heater offset flashes on the display.

⇨ Press the push-button. The word **ON** or **OFF** flashes on the display. Turn the adjustment knob to set the negative offset option to the desired state. After 10 seconds, the display returns to the heater offset value.

When the negative offset option is enabled, the offset ranges from -9.9°F to 20.0°F (-5.5°C to 11.1°C).

TROUBLESHOOTING GUIDE

PROBLEM	CAUSE	SOLUTION
The display doesn't work.	The circuit breaker on the service panel is off or tripped.	Reset the circuit breaker.
	The wiring is incorrect.	Fix the wiring.
	The F6 input fuse is open.	Replace the fuse.
	The voltage selector switch is in the wrong position.	Set the switch to the correct position.
	The display board interconnect cable is unplugged from the power supply board.	Plug the cable.
The display shows the letter "P"	The corresponding probe is improperly connected.	Fix the probe's connection.
The Defective Probe Pilot Light is on.	One or more probes are defective.	Follow the procedure described in DETECTING FAULTY PROBES to identify and replace the defective probe.
The display shows sudden variations in the room temperature.	A variation in resistance is induced on a probe.	Make sure the probes are dry and move them away from drafts and sources of radiant heating.
	There is electrical noise near an extended probe cable.	Do not run probe cables next to other power cables. When crossing other power cables, cross at 90°.

PROBLEM	CAUSE	SOLUTION
The fans or heating units connected to one of the stages are not operating.	The stage's fuse is open.	Replace the fuse.
	The display board interconnect cable is not plugged into the power supply board properly.	Make sure the cable is firmly plugged in with the tabs in place.
	The wiring is incorrect.	Correct the wiring. In particular, make sure two different lines are connected to each motor: line L1 modulated by the controller should be combined with another line (N for 115V or L2 for 230V) to activate the motor or heating unit. Also, make sure the stage's COMMON is supplied by line L1.
	The fan motor or heating unit is defective.	Verify if the motor or heating unit is defective by connecting it to an alternate power supply. Replace the motor or heating unit If it still is not operating.
	The controller is defective.	Listen to see if there is a clicking sound when the stage's pilot light turns on. If there is no clicking sound, contact your distributor to repair the controller.

PROBLEM	CAUSE	SOLUTION
Stages 3 and 4 are not running as expected.	The internal switches are improperly set.	Verify the internal switch settings.
The stage 1 fans do not stop running when the controller is operating in minimum ventilation cycle.	Time off is set to zero. The wiring is incorrect.	Set time off to a value other than zero. Correct the wiring. In particular, make sure two different lines are connected to each motor: line L1 modulated by the controller should be combined with another line (N for 115V or L2 for 230V) to activate the motor or heating unit. Also, make sure the stage's COMMON is supplied by line L1.

TECHNICAL SPECIFICATIONS

Supply: - 115/230 VAC (-18%,+8%), 50/60 Hz, overload and overvoltage protection fuse F6-1A fast blow.

- 12 VDC for AC back-up supply, can activate all outputs if supplied with DC back-up voltage.

Stage 1: ON-OFF output, 115/230 VAC, 50/60 Hz, 30 VDC, 6A FAN, 10A RES, fuse F1-10A slow blow.

Stage 2: ON-OFF output, 115/230 VAC, 50/60 Hz, 30 VDC, 6A FAN, 10A RES, fuse F2-10A slow blow.

Stage 3: ON-OFF output, 115/230 VAC, 50/60 Hz, 30 VDC, 6A FAN, 10A RES, fuse F3-10A slow blow.

Stage 4: ON-OFF output, 115/230 VAC, 50/60 Hz, 30 VDC, 6A FAN, 10A RES, fuse F4-10A slow blow.

Probes: Low voltage (< 5V), isolated from the supply. Operating range: -40.0° to 120.0°F (-40.0° to 48.9°C). Accuracy: 1.8°F (1°C) between 41° and 95°F (5° and 35°C).

Enclosure: ABS, moisture and dust-tight.

The room temperature where the controller is located MUST ALWAYS REMAIN BETWEEN 32° AND 104°F (0° AND 40°C).